

I claim:

1. An inflatable restraint assembly for an automotive vehicle, the apparatus comprising:

5 a support structure;

an air bag deployment door integrally formed in a vehicle panel, the air bag deployment door having a perimeter, at least a portion of the perimeter defined by a frangible marginal edge;

10 an air bag dispenser supported adjacent a door inner surface opposite a door outer surface;

15 an air bag supported in an air bag receptacle of the air bag dispenser, the air bag having an inner end operatively connected to the air bag dispenser and an outer end disposed adjacent the air bag deployment door, the air bag dispenser configured to direct air bag deployment and along a deployment path through the vehicle panel;

20 a reaction plate disposed between the air bag and the air bag deployment door;

the reaction plate including a pivotable panel portion configured to pivot outward under the force of air bag inflation; and

25 the reaction plate connected to the support structure.

2. An inflatable restraint assembly as defined in claim 1 in which the reaction plate includes a tether that integrally extends from the pivotable panel portion of the reaction plate and is connected to the support structure.

3. An inflatable restraint assembly as defined in claim 2 in which the support structure comprises the interior vehicle panel.

30 4. An inflatable restraint assembly as defined in claim 2 in which the support structure comprises the air bag dispenser.

5. An inflatable restraint assembly as defined in claim 2 in which the tether is connected to the door.

5 6. An inflatable restraint assembly as defined in claim 2 in which the tether and pivotable panel portion are a single unitary piece.

7. An inflatable restraint assembly as defined in claim 1 in which the door and vehicle panel are a single unitary piece.

10 8. An inflatable restraint assembly as defined in claim 1 in which the reaction plate includes a marginal outer edge portion having a shape generally identical to and aligned with at least a portion of the frangible marginal edge of the air bag deployment door.

15 9. An inflatable restraint assembly as defined in claim 1 in which the reaction plate is supported along a reaction plate inner edge and in which an outer portion of the reaction plate is outwardly pivotable away from the air bag dispenser by bending the reaction plate along a first hinge line extending parallel to the attached reaction plate inner edge.

20 10. An inflatable restraint assembly as defined in claim 1 in which at least a portion of the reaction plate is disposed adjacent the door inner surface.

25 11. An inflatable restraint assembly as defined in claim 1 in which at least one rib extends integrally inward from the door inner surface toward the reaction plate.

30 12. An inflatable restraint assembly as defined in claim 11 in which a plurality of integral ribs extend integrally inward from an inner surface of the pivotable panel portion of the reaction plate.

13. An inflatable restraint assembly as defined in claim 12 in which the integral ribs include vertical and horizontal intersecting ribs.

14. An inflatable restraint assembly as defined in claim 1 in which the pivotable panel portion of the reaction plate is fastened to the door inner surface by a screw threaded into a boss, the boss extending integrally inward from the air bag deployment door.

15. An inflatable restraint assembly as defined in claim 2 in which the tether is fastened to the vehicle panel by a screw threaded into a boss, the boss extending integrally inward from the vehicle panel.

10

16. An inflatable restraint assembly as defined in claim 1 in which the reaction plate comprises a plastics material.

15

17. An inflatable restraint assembly as defined in claim 16 in which the reaction plate comprises thermoplastic urethane.

20

18. An inflatable restraint assembly as defined in claim 2 in which the integral tether is connected to the support structure by a sliding hinge configured to allow the reaction plate to slide outwardly when the air bag deploys and forces the reaction plate to pivot outward.

25

19. An inflatable restraint assembly as defined in claim 18 in which the integral tether is connected to the support structure by a fastener, the sliding hinge including a slotted fastener hole in the integral tether configured to slidably receive a shaft portion of the fastener to allow the integral tether to slide outwardly.

30

20. An inflatable restraint assembly as defined in claim 2 in which the integral tether includes fanfolds configured to allow the tether to elongate when a deploying air bag forces the reaction plate outward.

21. An inflatable restraint assembly as defined in claim 1 in which a first tubular channel is disposed along at least a portion of the air bag door perimeter.

22. An inflatable restraint assembly as defined in claim 21 in which the first tubular channel is disposed opposite an outer surface of the air bag door and vehicle panel.

5

23. An inflatable restraint assembly as defined in claim 21 further including a second structural channel disposed adjacent and parallel to the first tubular channel, the perimeter being disposed between the first and second tubular channels, one of the tubular channels being integrally formed with the door and the other tubular channel being integrally formed with the vehicle panel.

10

24. An inflatable restraint assembly as defined in claim 23 in which the frangible marginal edge is defined by an elongated gap defined by and disposed between the first and second tubular channels.

15

25. An inflatable restraint assembly as defined in claim 24 further including an elongated groove disposed in the outer surface opposite the elongated gap.

20

26. An inflatable restraint assembly as defined in claim 1 in which the frangible marginal edge defines the entire air bag deployment door perimeter.

25

27. An inflatable restraint assembly as defined in claim 23 in which the frangible marginal edge and the pair of tubular channels are formed around approximately 270° of the air bag door.

30

28. An inflatable restraint assembly as defined in claim 21 in which a screw boss integrally extends inward from the tubular channel and is configured to receive a fastener connecting the reaction plate to the screw boss.

29. An inflatable restraint assembly as defined in claim 21 in which a tubular channel extends integrally inward from the inner surface of the door and a screw boss integrally extends inward from that tubular channel, the screw boss being configured to receive a fastener connecting the reaction plate to the screw boss.

30. An inflatable restraint assembly as defined in claim 1 in which the frangible marginal edge of the door comprises a region of reduced cross section.

10

31. An inflatable restraint assembly as defined in claim 1 in which the air bag deployment door includes a marginal edge that forms a hinge between the vehicle panel and the door.

15

32. An inflatable restraint assembly as defined in claim 1 in which a flexible skin covers at least a portion of the vehicle panel in a layered disposition.

20

33. An inflatable restraint assembly as defined in claim 1 in which a foam layer covers at least a portion of the vehicle panel.

34. An inflatable restraint assembly as defined in claim 31 in which:

the door and panel comprise a first material; and

25 the hinge includes a hinge panel comprising a second material embedded at least partially within the first material and spanning the door perimeter.

35. An inflatable restraint assembly as defined in claim 31 in which the hinge is invisible on an outer surface of the vehicle panel.

30

36. An inflatable restraint assembly as defined in claim 34 in which the hinge panel includes:

a first end embedded in a portion of the first material that forms the door;

a second end embedded in a portion of the first material that forms the vehicle panel; and

5 a mid portion disposed between the first and second ends, the mid portion having an outer surface covered with a portion of the first material that forms the outer surface of the air bag door and vehicle panel, the mid portion having an exposed inner surface disposed opposite the outer surface.

10 37. An inflatable restraint assembly as defined in claim 34 in which the second material includes any one or more materials from a group of materials including thermoplastic rubber, glass matte, fabric and metal.

15 38. An inflatable restraint assembly as defined in claim 1 in which:

the perimeter of the air bag door is generally shaped to approximate the shape of the air bag canister opening; and

the frangible marginal edge at least partially defines an arcuate shape for the air bag door.

20 39. An inflatable restraint assembly as defined in claim 38 in which the air bag canister opening has the same general arcuate shape as the air bag door.

25 40. A method for making an inflatable restraint assembly for passengers in automotive vehicles, the assembly comprising an air bag door integrally formed in an automotive trim panel of a plastic material, the integral air bag door defined at least in part by a frangible marginal edge, the air bag door movable from the closed position to provide a path for an air bag to deploy through, the air bag door being movable out of the closed position by at least 30 partially separating from the trim panel along a door perimeter at least partially defined by the frangible marginal edge, and a tubular channel disposed along the frangible marginal edge; the method including the steps of:

providing a mold configured to form the shape of the integral air bag door and trim panel and the tubular channel;

providing material in the mold;

5 injecting gas into a portion of the material disposed in a portion of the mold configured to form the tubular channel;

allowing the material to solidify within the mold; and

removing the solidified material from the mold.

10 41. A method as set forth in claim 40 in which the step of providing a mold includes the step of providing a mold configured to form the shape of an air bag door including a door perimeter at least partially defined by a frangible marginal edge comprising a region of reduced thickness.